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#3



PATENT
1817-0119P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Eanna P. TIMONEY et al. Conf.: 1538
Appl. No.: 10/071,078 Group: 3617
Filed: February 11, 2002 Examiner: UNKNOWN
For: A VEHICLE DRIVELINE

Priority
Paper
7-11-03

L E T T E R

Assistant Commissioner for Patents
Washington, DC 20231

April 10, 2002

Sir:

Under the provisions of 35 U.S.C. § 119 and 37 C.F.R. § 1.55(a), the applicants hereby claim the right of priority based on the following application:

<u>Country</u>	<u>Application No.</u>	<u>Filed</u>
IRELAND	S2001/0127	February 9, 2001

A certified copy of the above-noted application is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

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JMS/ghh
1817-0119P

Attachment

Group 3617
S.N. 101071078
1 of 1
Brid Stewart et al.
(703) 205-8000
att. Doc 1781-0119P



Patents Office
Government Buildings
Hebron Road
Kilkenny

I HEREBY CERTIFY that annexed hereto is a true copy of documents filed in connection with the following patent application:

Application No. S2001/0127

Date of Filing 9 February 2001

Applicant TECHNOLOGY INVESTMENTS LIMITED, an Irish Company of Gibbstown, Navan, County Meath, Ireland.

Dated this day of January 2002.



An officer authorised by the
Controller of Patents, Designs and Trademarks.

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REQUEST FOR THE GRANT OF A PATENT

PATENTS ACT 1992

The Applicant(s) named herein hereby request(s)
[] the grant of a patent under Part II of the Act
[X] the grant of a short-term patent under Part III of the Act
on the basis of the information furnished hereunder.

1. Applicant(s)

TECHNOLOGY INVESTMENTS LIMITED.
Gibbstown
Navan
County Meath
Ireland
an Irish Company

2. Title of Invention

A vehicle driveline

3. Declaration of Priority on basis of previously filed application(s) for same invention (Sections 25 & 26)

<u>Previous Filing</u> <u>Date</u>	<u>Country in or for</u> <u>which filed</u>	<u>Filing No.</u>
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4. Identification of Inventor(s)

Name(s) and addresse(s) of person(s) believed
by the Applicant(s) to be the inventor(s)

Anthony Ryalls
a British Subject of 26 Breach Road, Heanor, Derbyshire DE7 7HJ,
England
Eanna Pronsiass Timoney
an Irish Citizen of St Anthony's, Boyne Road, Navan, County Meath,
Ireland

5. Statement of right to be granted a patent (Section 17(2) (b))

The Applicant derives the right to apply by virtue of a Deed of Assignment dated December 21, 2000

6. Items accompanying this Request

- (i) [X] prescribed filing fee (IRP 50)
- (ii) [] specification containing a description and claims
[X] specification containing a description only
[X] Drawings referred to in description or claims
- (iii) [] An abstract
- (iv) [] Copy of previous application(s) whose priority is claimed
- (v) [] Translation of previous application whose priority is claimed
- (vi) [X] Authorisation of Agent (this may be given at 8 below if this Request is signed by the Applicant(s))

7. Divisional Application(s)

The following information is applicable to the present application which is made under Section 24 -

Earlier Application No.

Filing Date:

8. Agent

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted -

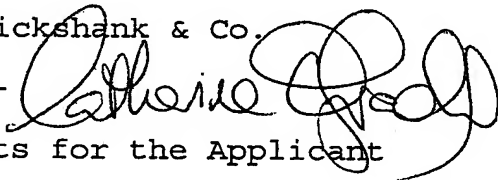
Name & Address

Cruickshank & Co. at their address recorded for the time being in the Register of Patent Agents is hereby appointed Agents and address for service, presently 1 Holles Street, Dublin 2.

9. Address for service (if different from that at 8)

Signed Cruickshank & Co.

By:-



Executive.

Agents for the Applicant

Date February 09, 2001.

"A vehicle driveline"Introduction

- 5 The invention relates to a driveline for a multi-axle vehicle.

10 The invention is suitable for use in 6 x 6, 8 x 8, and 10 x 10 vehicle drive lines. For example, an 8 x 8 vehicle has four driven axles, each incorporating a differential unit that in turn drives two wheel sets, one at each side of the vehicle. It is known in practice to distribute the drive power from the engine through the main transmission gear box via a propeller shaft to a central torque transfer case incorporating a differential unit that splits the drive between the front and the rear of the vehicle. From the central torque transfer case, a first output drive goes via a propeller shaft towards the front of the vehicle to a front torque transfer mechanism incorporating a differential unit that splits the drive between the first and the second axle of the vehicle. Also, from the central torque transfer case, a second output drive goes via propeller shaft towards the rear of the vehicle to a rear torque transfer mechanism incorporating a differential unit that splits the drive between the third and fourth axle of the vehicle.

20 In known applications, these three torque transfer cases with their associated differential units take up room that would otherwise be available for useful cargo or equipment. It is known practice to integrate the front and rear torque transfer mechanisms and associated differentials with the second and third axle differential units respectively of an 8 x 8 vehicle and the close-coupled assembly may be termed "a through-drive axle". Frequently, the input shaft to the through-drive axle has an axis perpendicular to and vertically displaced from the axle centreline. The drive is split in an inter-axle differential unit and the through-drive to the next axle is on the same axis as the input shaft. The drive to the local axle differential is transmitted through parallel axis gears to allow for the vertical displacement of the input shaft from the axle centreline. In an 8 x 8 vehicle with this drive line layout, the central torque transfer case and the front and rear torque transfer mechanisms and their associated differentials all lie between the second and third axes of the vehicle. This can cause a problem if it is desirable that the second and third axles be closely spaced or if, for example, space must be reserved for equipment such as a weapon turret. Also,

because the through-drive from the second axle to the first or front axle is on an axis that is vertically displaced from the axle centreline, the propeller shaft between the axles is at an angle that may be excessive, particularly if the axles are closely spaced. Similarly, the propeller shaft angle between the third and fourth axles may be excessive.

The present invention is directed towards overcoming these problems.

Statements of Invention

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According to the invention, there is provided a driveline for a vehicle incorporating a through-drive axle unit which is a close-coupled assembly comprising a torque transfer mechanism with associated differential unit and an axle differential unit in which an output shaft of the through-drive is on substantially the same axis as an input pinion to the axle differential unit.

15

In another embodiment, the invention provides a driveline for a vehicle incorporating an integrated transfer box and through-drive axle unit which is a close-coupled assembly comprising two torque transfer mechanisms with two associated differential units and an axle differential unit.

20

In a further embodiment, said integrated transfer box and through-drive axle assembly includes first and second torque transfer mechanisms with their two associated differential units, and an axle differential unit is associated with a second axle from the front of the vehicle, takes its drive input from the vehicle engine via a main change-speed gearbox and a drop-box, has a first output from the first torque transfer mechanism towards the rear of the vehicle which drives the rear two axles through a through-drive axle unit located at a third axle from the front of the vehicle, has a second output from the first torque transfer mechanism towards the front of the vehicle which drives the front two axles through a second torque transfer mechanism which has one output close-coupled with an axle differential unit of the second axle and a second output towards the front of the vehicle to a propeller shaft which drives an input shaft of a front axle differential.

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In another aspect, the invention provides a through drive axle unit for a vehicle driveline including:-

a drive input shaft,

5

the drive input shaft being drivably connected to a first differential unit,

the first differential unit having a first output and a second output,

10

the first output being drivably connected to an output shaft for onward drive transmission,

the second output being drivably connected to an axle differential unit having first and second drive outputs for connection to wheels of a vehicle.

15

In a preferred embodiment, the output shaft is on substantially the same axis as an input pinion to the axle differential unit.

20

In a further aspect, the invention provides an integrated transfer box and through-drive unit for a vehicle driveline, including:-

a drive input shaft,

25

the drive input shaft being drivably connected to a first differential unit,

the first differential unit having a first output and a second output,

the first output being drivably connected to a first output shaft for onward drive transmission,

30

the second output being drivably connected to a second differential unit,

the second differential unit having a first output and a second output,

the second differential unit first output being drivably connected to a second output shaft for onward drive transmission,

5 the second differential unit second output being drivably connected to an axle differential unit having first and second drive outputs for connection to wheels of a vehicle.

10 In a preferred embodiment, the first output of the second differential unit is on substantially the same axis as an input pinion to the axle differential unit.

In another embodiment, the second output of the first differential unit is drivably connected to the second differential unit through a parallel axis gear pair.

Detailed Description of the Invention

15 The invention will be more clearly understood by the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:-

20 Fig. 1 is a schematic perspective view of an 8 x 8 vehicle drive line according to the invention illustrating the location of each major component,

Fig. 2 is a sectional elevational view of an integrated transfer box and through-drive axle unit according to the invention, and

25 Fig. 3 is a sectional elevational view of a through-drive axle unit according to the invention.

30 Referring to the drawings, there is shown an 8 x 8 vehicle drive line according to the invention, indicated generally by the reference numeral 1. Drive from the engine and transmission gear box (not shown) goes forward to a drop box 2. A propeller shaft 3 takes the drive under the transmission gear box and engine to the integrated transfer box and through-drive axle unit 4, which is illustrated in more detail in Fig. 2 and is located at the second axle position from the front of the vehicle.

Fig. 2 shows a cross-sectional view of an integrated transfer box and through-drive axle unit 4 in accordance with the invention. The drive comes in on input flange and shaft 5 and is transferred by a parallel axis gear pair 41 to a first differential unit 42, which may be a standard differential, a limited slip differential, or any other suitable type of differential. A first output from the differential unit 42 provides a drive towards the rear of the vehicle through coupling flange 6 and a second output provides a drive towards the front of the vehicle through a parallel axis gear pair 43 to a second differential unit 44. A first output from the second differential unit 44 provides a drive towards the front of the vehicle through coupling flange 7 and a second output drives the axle differential unit 45, which has first and second outputs to coupling flanges 8 on each side of the unit 4.

Referring again to Fig. 1, a first output from integrated transfer box and through-drive axle unit 4 through coupling flange 6 and propeller shaft 10, drives an input coupling flange 11 of a through-drive axle unit 9, which is illustrated in more detail in Fig. 3 and is located at the third axle position from the front of the vehicle.

Fig. 3 shows a cross-sectional view of a through-drive axle unit 9 in accordance with the invention. The drive comes in on input flange and shaft 11 and is transferred by a parallel axis gear pair 91 to a first differential unit 92, which may be a standard differential, a limited slip differential, or any other suitable type of differential. A first output from the differential unit 92 provides a drive towards the rear of the vehicle through coupling flange 12 and a second output drives the axle differential unit 93 which has first and second outputs to coupling flanges 13 on each side of the unit 9.

Referring again to Fig. 1, a second output from integrated transfer box and through-drive axle unit 4 through coupling flange 7 and propeller shaft 14 drives an input coupling flange 16 of a first or front axle differential unit 17, which has output coupling flanges 18 on each side. A first output from through-drive axle unit 9 through coupling flange 12 and propeller shaft 19 drives an input coupling flange 20 of a fourth or rear axle differential unit 21, which has output coupling flanges 22 on each side. Axle differential units drive the wheels at the front, second, third and rear axle positions through pairs of coupling flanges 18, 8, 13 and 22 respectively.

It will be appreciated that this arrangement allows a minimum spacing between axes 2 and 3 and maximises the free space between these axes. Also, because coupling flanges 7 and 16 are axially aligned, the propeller shaft 14 has no angulation, which
5 allows a minimum spacing between the front and second axes. Similarly, the propeller shaft 19, between the third and rear axle, is perfectly aligned.

It will be appreciated that the embodiment of the invention described above is suitable for use in an 8 x 8 vehicle drive line. It will be understood that the through-drive unit
10 may be associated with an axle other than the third axle as illustrated and that the integrated transfer box and the through-drive unit may be associated with an axle other than the second axle as illustrated.

It will further be appreciated that the present invention mitigates the problems
15 associated with the prior art by close coupling two of the torque transfer mechanisms with one axle differential unit without any intervening propeller shafts and close coupling the remaining torque transfer mechanism with another axle differential unit. The invention minimises the number of drive shafts and allows for good alignment of the drive shafts and a compact layout of the drive line. It can also be usefully
20 employed in vehicles with three, five or more driven axes.

The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail.